SLOVENSKI STANDARD
SIST-TS CEN/TS 15901-13:2011

01-september-2011

Značilnosti cestnih in letaliških površin - 13. del: Postopek določanja torne sposobnosti vozne površine z določanjem koeficienta bočne sile (SFCO): Odoliograf

Road and airfield surface characteristics - Part 13: Procedure for determining the skid resistance of a pavement surface by measurement of a sideway force coefficient (SFCO): the Odoliograph

Oberflächeneigenschaften von Straßen und Flugplätzen - Teil 13: Verfahren zur Bestimmung der Griffigkeit von Fahrbahndecken durch Messung des Seitenreibungsbeiwerts (SFCS): das Odoliograph-Messgerät

Caractéristiques de surface des revêtements de chaussée des routes et des aérodromes - Partie 13: Mode opératoire de détermination de l'adhérence de la surface d'un revêtement de chaussée par mesurage d'un coefficient de frottement transversal (CFTO): l'odoliographe

Ta slovenski standard je istoveten z: **CEN/TS 15901-13:2011**

ICS:

17.040.20	Lastnosti površin	Properties of surfaces
93.080.10	Gradnja cest	Road construction
93.120	Gradnja letališč	Construction of airports

SIST-TS CEN/TS 15901-13:2011 **en,fr,de**

TECHNICAL SPECIFICATION

SPÉCIFICATION TECHNIQUE

TECHNISCHE SPEZIFIKATION

CEN/TS 15901-13

March 2011

ICS 93.120; 93.080.20

English Version

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Ref. No. CEN/TS 15901-13:2011: E

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Foreword

This document (CEN/TS 15901-13:2011) has been prepared by Technical Committee CEN/TC 227 “Road materials”, the secretariat of which is held by DIN.

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1 Scope

This Technical Specification describes a method for determining the wet-road skid resistance of a surface by measurement of a sideway force coefficient SFCO. The method provides a measure of the wet-road skid resistance properties of a bound surface by measurement of sideway-force coefficient at a controlled speed. The method has been developed for use on roads but is also applicable to other paved areas such as airport runways.

This Technical Specification covers the operation of the Odoliograph. This is a device developed by the Belgian Road Research Centre that uses the side-force principle to make routine, expertise and research measurements of skid resistance continuously on long lengths of road.

A machine conforming to the general characteristics of the Odoliograph designed by the Belgian Road Research Centre and the specific provisions of this document may also be used for the tests.

The skid resistance of a pavement is determined by friction measurements and measurements of pavement texture. Where measurement of pavement texture is required the standard for this measurement and the device is described in EN ISO 13473-1.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 48, *Rubber, vulcanised or thermoplastic — Determination of hardness (hardness between 10 IRHD and 100 IRHD)*

ISO 4662, *Rubber, vulcanized or thermoplastic — Determination of rebound resilience*

3 Recommended uses

This method provides a means for the evaluation of the skid resistance of a road surfacing. It is suitable for use for the following situations:

— testing new surfacing materials when installed in a road trial for type approval purposes;

— testing new surfacing materials for contractual compliance purposes;

— for routine determination of the skid resistance of the surface of a road in service;

— research.

4 Terms and definitions

For the purposes of this document, the following terms and definitions apply

4.1
friction
resistance to relative motion between two bodies in contact

NOTE The frictional force is the force which acts tangentially in the contact area

4.2
skid resistance
characterisation of the friction of a road surface when measured in accordance with a standardised method

4.3
wet road skid resistance
property of a trafficked surface that limits relative movement between the surface and the part of a vehicle tyre in contact with the surface, when lubricated with a film of water

NOTE Factors that contribute to skid resistance include the tyre pressure, contact area, tread pattern, and rubber composition; the alignment, texture, surface contamination, and characteristics of the road surface; the vehicle speed; and the weather conditions.

The skid resistance of a road surface in Europe varies seasonally. Generally, wet skid resistance is higher in winter as a result of the effects of wet detritus and the effects of frost and wear by tyres on microtexture and macrotexture. Wet skid resistance is lower in summer as a result of dry polishing by tyres in the presence of fine detritus.

The change in skid resistance of a surface in service is affected by the volume of traffic and the composition of the traffic, i.e. cars, buses, commercial vehicles of different sizes, as the tyres of these vehicles polish and/or wear away the surfacing material in different ways. The geometry of the road will affect the change in skid resistance. Generally, tyres polish less on straight roads than on bends.

Where the surface contains aggregate with a coating of binder, e.g. bitumen, resin or Portland cement, the skid resistance will change as the coating is worn away by tyres.

4.4
bound surface
top layer or surface course of a road with the aggregates secured permanently in place

NOTE Aggregates are commonly secured in place by bitumen or Portland cement.

4.5
operating speed
speed at which the device traverses the test surface

4.6
contact area
overall area of the road surface instantaneously in contact with a tyre

NOTE This term describes the overall area generally covered by the tyre. Due to the effects of surface texture or any tyre tread pattern, not all of the tyre or road surface in the contact area may be in contact at any instant.

4.7
slip speed
relative speed between the test tyre and the travelled surface in the contact area

4.8
slip ratio
slip speed divided by the operating speed

NOTE for devices meeting the requirements of this document the slip ratio is fixed by the angle of the test wheel

4.9
horizontal force (side force)
force acting perpendicular to the rotation plane of a freely-rotating, angled/tilted test wheel, along the axis of rotation

4.10
side force coefficient
SFC
ratio between the vertical force (load) and horizontal force (side force) in controlled conditions

NOTE 1 This is normally a decimal number quoted to two significant figures.

NOTE 2 SFC varies depending on the wheel angle of the device and the operational speed.

4.11
SFCO
sideway-force coefficient measured with a device using a wheel in accordance with this document

4.12
Odoliograph
device developed by the Belgian Road Research Centre (BRRC) that uses the side-force principle to make measurements of skid resistance continuously.

NOTE All devices are manufactured under license from BRRC.

4.13
sampling length
distance over which responses of the sensors are sampled to determine a single measurement of the recorded variables

NOTE 1 The sampling length depends upon the detailed operation of device and its recording system; a number of samples may be combined to determine a measurement for a subsection.

NOTE 2 This should not be confused with horizontal resolution which is the shortest distance over which a change in the measured parameter can be detected.

4.14
subsection
defined length of surface for which one set of the measured variables is reported by the device

NOTE Different devices may use different subsections depending on the context of the measurements, such as 5 m, 10 m or 20 m.

4.15
test section
length of road between defined points (e.g. location references, specific features, or measured distances) comprising a number of subsections over which a continuous sequence of measurements is made

4.16
water delivery system
system for depositing a given amount of water in front of the test tyre so that it then passes between the tyre and the surface being measured

4.17
water flow rate
rate (litres/second) at which water is deposited on the surface to be measured in front of the test tyre

4.18
theoretical water film thickness
theoretical thickness of a water film deposited on the surface in front of the measuring tyre, assuming the surface has zero texture depth

4.19
wheelpath
parts of the pavement surface where the majority of vehicle wheel passes are concentrated

NOTE The wheel path is not a fixed location on a pavement surface. On a worn pavement, the wheel path is usually easily identified visually. On a newly laid surface, the position of the wheel path has to be estimated by experienced operators.

For special circumstances such as acceptance tests, a particular path may be defined, for example, (700 ± 150) mm from the edge of the running lane of a road.

4.20
nearside wheelpath
wheelpath that is closest to the edge of the road in the normal direction of travel

NOTE For countries that normally drive on the right, this is the right-hand side and for countries that normally drive on the left, this is the left-hand side.

5 Safety

Safety measures shall be in place to maintain safe working practice in accordance with current regulations, and to ensure the safety of other road users, including measures to control traffic as necessary.

NOTE The wetting of surfaces can have an effect on other users of the site and every effort should be made to ensure that they do not have to make any sudden changes in speed or direction.

When measuring skid resistance on trafficked roads the device may operate at speeds different to normal road speeds and as a result may create a hazard to other road users. The test speed specified when calling for tests in accordance with this standard should take this into account.

Testing should not be carried out if there is a risk of water freezing on the pavement.

Most devices are fitted with a test wheel on one side only, positioned for testing in the nearside wheelpath of their home country. Such machines cannot normally be used to test in the other wheelpath without straddling the edge of the lane and should not be so used unless there is sufficient room to do so safely and appropriate safety measures regarding other traffic are taken. Some machines are fitted with a test wheel on both sides.

6 Essential characteristics

6.1 Principle of measurements

Machines meeting this document operate on the sideways-force principle using a special test wheel, set at an angle to the direction of travel, which generates a slipping condition as it is towed along the wetted pavement surface. The slipping force on the wheel is measured. A typical device is illustrated in Figure 1.

6.2 Operating principle

A controlled slipping condition is achieved by mounting a freely rotating test wheel with its vertical plane at an angle to the longitudinal axis of the test vehicle. When the vehicle is in motion, the test wheel slides or slips in the forward direction.

A freely rotating wheel fitted with a special pneumatic, smooth, rubber tyre, mounted mid-machine in line with the nearside wheel path and tilted/angled at 20° to the direction of travel of the vehicle, is applied to the road surface under a known static vertical load.

A controlled flow of water wets the road surface immediately in front of the test wheel, so that when the vehicle moves forward, the test wheel slides in the forward direction along the surface. The force generated by